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ABSTRACT

This material is a supplement to existing mathematics programs for young learners. The activities presented are based on assumptions about the young problem solver which are difficult to address in standard mathematics texts. In these pages it is assumed that each learner brings to the problem-solving effort a very personal experience base and a unique repertoire of approaches, strategies, and evaluative behaviors for solving problems. It is also assumed that true problem solving is not so much a search for the appropriate rule or algorithm, but rather a response to a personal inquiry characterized by exploration and discovery. Units include: (1) "The Corner Store"; (2) "The Track Meet"; (3) "The Construction Site"; and (4) "The Service Station." Answer keys and objectives for activities presented are provided. (YP)

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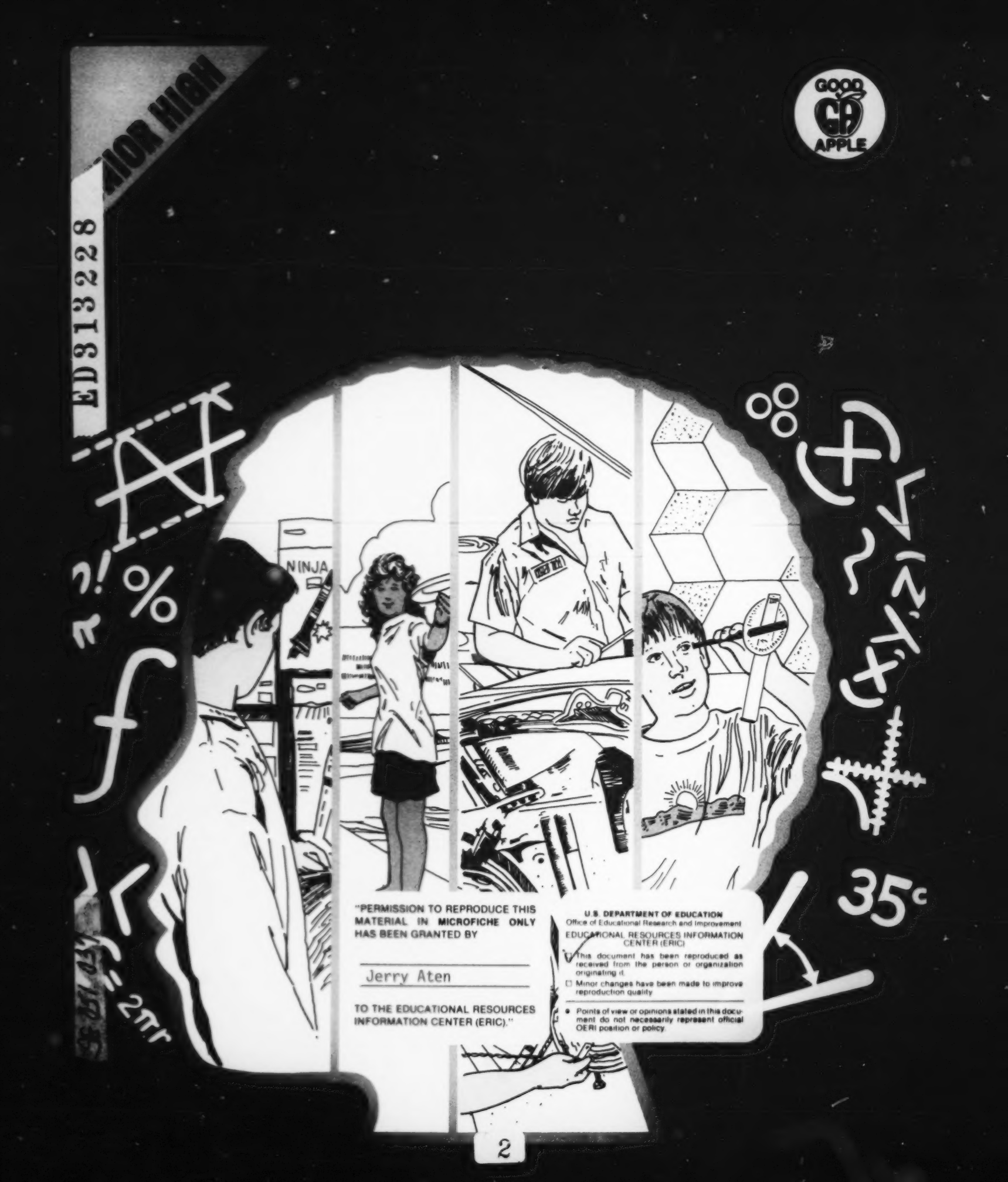

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PRACTICAL MATH SKILLS

Situations — Strategies — Solutions

Junior High Level

by

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illustrated by Darcy Tom

Cover by Vanessa Filkins

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Description of Kino Learning Center

Kino Learning Center is a private, nonprofit elementary and secondary school founded in Tucson, Arizona, in 1975 by parents seeking a futuristic learning model for children. The school not only emphasizes the conventional skills of reading, writing and computing, but goes beyond these basics to the contemporary skills of choosing, relating, valuing, creating and learning how to learn.

Within the prepared environment of the school, each student is free to choose from worthwhile options, a sequence of activities unique to his/her needs and experiences, and in which he/she finds success, interest and pleasure. Each student is free to develop in the way and at the pace appropriate to his/her needs, abilities and interests. The school places special emphasis on individual discovery, on firsthand experience and on creative work.

At Kino Learning Center, adults, children and adolescents mutually engaged in the learning process are continually in the process of changing and growing, for to learn is to change. And to experience joy in learning is to delight in life itself, for learning and life are one.

The curriculum at Kino Learning Center consists of teacher-made learning packets containing facts, processes and values related to topics of interest to the students. These learning packets have been expanded into workbooks for use by teachers and students throughout the United States and Europe. Over thirty books are presently in circulation. The profits from the sale of these books are used to enhance the learning environment at Kino Learning Center.

Acknowledgements

I extend appreciation to Judy Bisignano for editing this book, Sandy Webb for typing the manuscript and Darcy Tom for bringing my words to life through her illustration of the students at Kino Learning Center. Special thanks to Suzanne Horst of Whiz Kids Books and Toys, Inc., for the illustrations in Unit One: The Corner Store. Most importantly, I thank Becky, Ashley and Charlie for sacrificing weekend fun for the advancement of mathematics for young people.

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Introduction

Practical Math Skills is a supplement to existing mathematics programs for young learners. The activities presented are based firmly on assumptions about the young problem solver which are difficult to address in standard mathematics texts. In these pages it is assumed that each learner brings to the problem-solving effort a very personal experience base and a unique repertoire of approaches, strategies and evaluative behaviors for solving problems. It is also assumed that true problem solving is not so much a search for the appropriate rule or algorithm, but rather a response to a personal inquiry characterized by exploration and discovery.

A quick check of the answer pages shows that many answers are expected to vary. Student performance of these activities must therefore be evaluated with an emphasis on process rather than answers. Solving problems is often like that.

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UNIT ONE:
THE CORNER STORE

Do you know:

The skills necessary to work at a retail store?

How a store provides a living for its employees?

What types of problems must be solved when working in retail situations?

What kinds of mathematical calculations and judgments are made by the owner? The manager? The employee? The customer?

Before you can solve practical retail problems, you must have some understanding of the sales business. A logical place to begin this education is at the corner store. In the summer, after school, and during the holidays, many young people work at retail outlets. What kinds of work do these teenagers do? What skills do they use in their work? With what problems are they frequently confronted?

The retail store is a rich mathematics environment because the people involved—owners, employees and customers—are consistently making mathematic calculations and judgments.

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Retailing

Retailing involves buying goods at one price and selling them at a higher price. The difference between the buying cost and the selling price constitutes the profit for the store. Expenses such as salaries, rent, advertising and utilities must be deducted from the store's profit. Some remaining profit is used to expand inventories, that is, increase the quantity of the goods the store will sell.

Discuss the following questions with your retail store owner. Write your answers to the questions in the space provided.

Where does the retail store obtain the merchandise that it sells to consumers?

_____

_____

_____

What factors determine the price of merchandise?

_____

_____

_____

What are some operational expenses for a store?

_____

_____

_____

What are some problems that an effective retail manager must recognize and solve?

_____

_____

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Consumerism

Selling the highest quality merchandise at the lowest possible price is the way to plan for a successful retail business. This often means choosing among comparable products. For this reason, it is important to stay aware of consumer reports on public taste preferences.

Use the following format to conduct a product preference test.

Test Question: Which of the three leading brands of bubble gum do people most prefer?

Testing Procedure: Wrap ten pieces of each brand name gum in aluminum foil. Label each piece A, B or C. Only you, the tester, should know the brand name of each sample.

Ask 10 subjects to chew gum A, B and C for 30 minutes each. Have each subject rate the gum every ten minutes for flavor, chewing consistency and "bubblability." Let 1 = superior, 2 = average and 3 = poor.

Data Collection: Use the following chart to record your data.

	SAMPLE A									SAMPLE B									SAMPLE C								
	Flavor			Consistency			Bubbles			Flavor			Consistency			Bubbles			Flavor			Consistency			Bubbles		
SUB-JECT	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30
1																											
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											

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Data Analysis: Calculate and compare the mean, median and mode score of the gum for each of the 10-minute intervals. Use the following chart to record your data.

	SAMPLE A									SAMPLE B									SAMPLE C								
	Flavor			Consistency			Bubbles			Flavor			Consistency			Bubbles			Flavor			Consistency			Bubbles		
	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30
MEAN																											
MEDIAN																											
MODE																											

Conclusions: Draw conclusions regarding the flavor, consistency, and "bubblability" of the three gums tested over a 30-minute time period. Write your conclusions in the space provided.

Most preferred gum: _____

Somewhat preferred gum: _____

Least preferred gum: _____

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Truth in Advertising

Besides evaluating the preference of consumers, the retail merchant must be aware of exaggerated claims made about some products. Consumer advocates often design tests to determine whether a product lives up to its advertising claims.

Design a test to evaluate the claims of three competing products. Use the format below to help you organize your research.

Test Question:

Test Procedure:

Data Collection:

Data Analysis:

Conclusions:

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Patterns: Finding the Simplest Case

Understanding patterns makes it possible to predict what is supposed to happen in mathematics. A function is the simplest mathematical expression of a pattern. This expression can take the form of a graph, a table, or a formula.

Express the functional relationship found in the following problem as a table, graph and formula.

A banquet for 200 people is planned at Donna's Deli and Sandwich Shop. Donna would like all the guests to sit at a single long table, but she doesn't have one. She has several small square tables designed to seat four people. Donna plans to push these tables together to form one long table. How many square tables must be pushed together to accommodate 200 guests?

How could these same number of tables be arranged to serve the fewest number of people?

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Noting Problem Variables

Noting the variables in a problem is helpful in solving many problems, especially those confounded with extraneous information.

Below are written notes of a problem solver. Eliminate the extraneous data and answer the questions posed.

Notes:

J got 36 votes.
B got 6 less votes than S.
S got 4 more than M.
J got 3/4 as many as M.
S and D got the same number of votes.
24 people didn't vote.

1. a. How many votes were cast?

   Information needed:

   _____

   Answer: _____

2. a. Who received the fewest votes?

   Information needed:

   _____

   Answer: _____

Notes:

Jerry has 647 Mexican stamps.
247 American stamps.
The rest are Canadian.

Has 1245 total stamps.

1. b. How many stamps in Jerry's collection are not American?

   Information needed:

   _____

   Answer: _____

2. b. How many Canadian stamps does Jerry have?

   Information needed: _____

   _____

   Answer: _____

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Searching for Numbers

Find equivalent pairs of decimals, percents or fractions. See if you can find 15 pairs. (Examples: 1/2 = 50%; .25 = 1/4)

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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Calculating Numbers

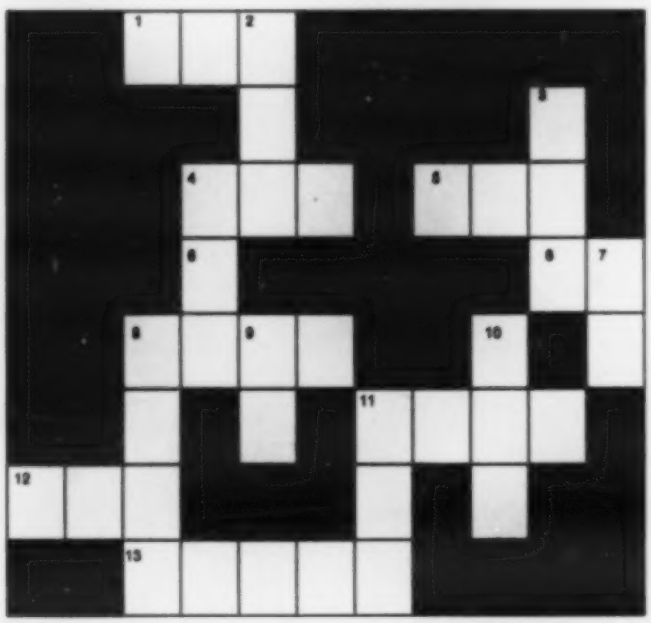
Calculators and cash registers are used to perform most mathematic computations by store employees. Use a calculator to complete the cross number puzzle.

ACROSS

1. Total number of eggs in twelve dozen
4. An 8¢ coupon on a $2.09 box of cereal
5. 3 loaves of bread at $1.08 a loaf
6. 5% tax on a purchase of $19.40
8. The sale price on a $13.60 bag of dog food marked "¼ off"
11. 6 dozen eggs at $1.95 each
12. 15 apples at $.19 each
13. Net profit after $1125.28 in gross sales and $321.55 in expenses

DOWN

2. Cost of a $5.00 purchase at 20% off
3. A refund of $3.15 on a $8.64 bill
4. A $75 rebate on a $335 TV
7. Unit price of 5 items for $3.95
8. A 15% gratuity added to a $9.20 lunch
9. If cola is $6.48 for a 24-can case, the unit price is _____.
10. Purchases of $2.45, $4.18, $.98 and $1.16
11. Change from a $20 bill after a purchase of $18.37



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Accounting

Spud McCoy owns The Couch Potato, a newly opened video store. Spud is having trouble calculating his profit for the month. He knows that some items must be credited to and others subtracted from his account. Help Spud balance his ledger book. Use the ledger sheet to record your work and answer the questions. Spud spent $325 for advertising.

Couch Potato
Anyplace, USA

Electric Company

Acct. #1529-7843-1

Amount Due:
$85.27

American Bell

Bill Date: January 10, 1988
Account No: 404-7928721

Couch Potato
Anywhere, USA

Total Amount Due $26.79

INVOICE #3220

Sold to: Couch Potato

Description	Amount
Records	$ 40.00
CDs	105.00
Videotapes	80.50
Total:	$225.50

785

89-1
—
222

January 31, 1988 _____

Pay to the order of Betty Russett $ 420.00

Four hundred and twenty and 00/100 _____

_____

120124 5891 3777 _____

Payroll Check 786

89-1
—
222

January 31, 1988 _____

Pay to the order of Robert Yam $ 210.00

Two hundred and ten and 00/100 _____

_____

120124 5891 3777 _____

1205

89-1
—
222

January 31, 1988 _____

Pay to the order of Idaho Mortgage Co. $ 250.00

Two hundred and fifty and 00/100 _____

_____

120124 5891 3777 _____

1206

89-1
—
222

January 31, 1988 _____

Pay to the order of U.S. Postmaster $ 52.00

Fifty-two and 00/100 _____

_____

120124 5891 3777 _____

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MONTHLY SUMMARY OF SALES
COUCH POTATO
Anyplace, USA

Month of: January 1988 _____

Item Description	Amount
Cash Sales of Records	$550.63
Charge Sales of Compact Discs	375.29
Charge Sales of Video Rentals	316.52
Cash Sales of Video Rentals	413.48
Merchandise Returns	198.18
Date _____	Authorized by _____

Description	Income	Expenses	Account Balance

1. What was Mr. McCoy's gross income for the month? _____
2. What were Mr. McCoy's total expenses for the month? _____
3. What was Mr. McCoy's net profit for the month? _____

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Group Problem Solving

Use the following guidelines for group problem solving:

1. Your group should have 2 to 4 members.
2. Each group member is responsible for his own behavior.
3. Before asking for help, be sure each group member agrees on the question.
4. Each group member must agree on the solution to the problem.

Simplifying a Problem

When a small store wishes to increase its number of shoppers, it does just what a large store does. It has a sale. However, instead of advertising in the newspaper or on television, a small store often hires people to personally deliver printed advertisements to all the houses in the neighborhood.

Delivering advertisements is one way a young person can earn spending money. Suppose a store owner gave you 650 flyers to deliver for 2¼¢ per flyer. You then decide to pay a friend $2.50 to fold all the ads and pack them in your delivery bag. After your friend had been folding papers for about half an hour, another friend asked to help. This friend could only fold about half as fast as the first. Nonetheless, they both finished the work in another 30 minutes. How much of the $2.50 should you pay your second friend?

Work together as a group to solve this problem. Show your work in the space below.

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Designing a Deli

A young business person wants to open a delicatessen and sandwich shop. This person has a list of essential equipment as well as a list of Health Department requirements. By coincidence, the building that has been rented is exactly the same size as your classroom. Given this information, help this person design the deli. (Hint: You may want to visit a delicatessen to observe its physical arrangement.)

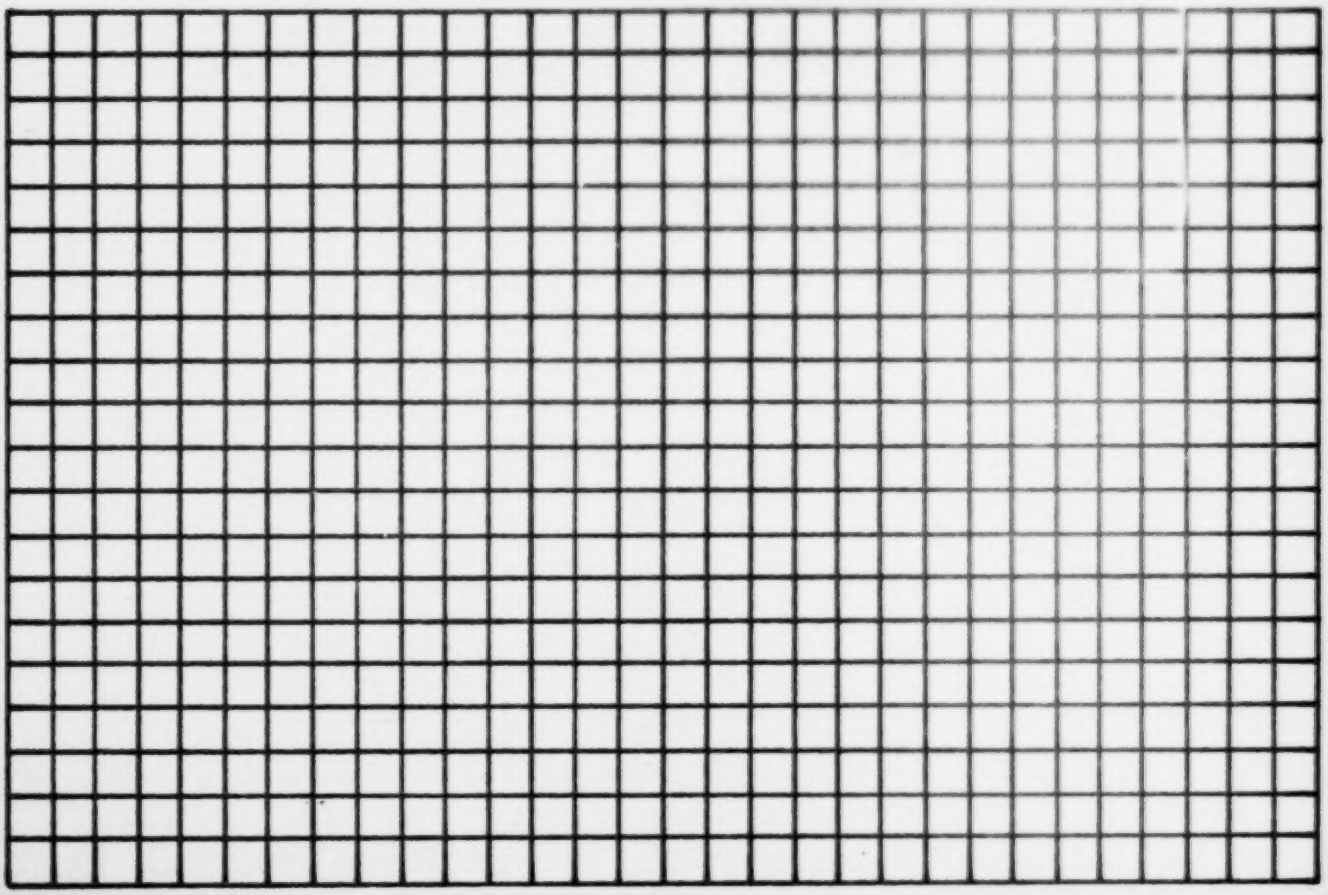
EQUIPMENT LIST

Item	Size
counter	16 ft. x 2.5 ft.
6 tables	3 ft. x 3 ft.
grill	5 ft. x 2 ft.
refrigerated display case	10 ft. x 4 ft.
display shelves	30 ft. x 4 ft.
dishwasher	8 ft. x 3 ft.
sink	2.5 ft. x 5 ft.
display cases	10 ft. x 3 ft.
2 garbage cans	1.5 ft. diameter
walk-in refrigerator	8 ft. x 10 ft.

HEALTH REQUIREMENTS

1. There must be a minimum of 33.5 sq. ft. behind the server's counter.
2. All cooking and cleaning equipment must be partitioned from the eating area.
3. Food preparation area must be at least 10 feet from dishwashing area.
4. Food disposal area must be separate from other areas and located near customer exit.
5. Patrons waiting for pickup orders may not stand in the eating area.

Use the graph paper below to make all measurements to scale.



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Problems at the Corner Store

Solve each problem in the space provided.

1. Mr. Rogers slashed the price of soda pop by 25% per case. What is the sale price per case if the original price was $12.60? _____
2. Juan's bill for sporting goods was $15.64. He paid with a twenty dollar bill. How much change did he receive? _____
3. If soap retails for 4 bars for $1.20, how much would it cost for 3 bars? _____
4. Mary earns $4.00 per hour stocking shelves. How much does she earn in 3½ hours? _____
5. John buys large quantities of wristwatches for $5.50 each, and sells them for $12.75 each. How many watches must John sell to make a profit of $275.50? _____
6. What is the unit price of an item that sells for $7.80 a dozen? _____
7. 20% of Jerry Clark's income is used to pay expenses. If Jerry spent $120.00 on expenses last week, what was his income? _____
8. How much money will Maria save by buying a $28.00 pair of shoes marked 15% off?

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More Problems at the Corner Store

Solve each problem in the space provided.

1. What is the sale price of a $32.00 item marked "15% off"? _____
2. What is the unit price of an item that is usually sold at a price of $3.54 for 6 items? _____
3. A cashier at the supermarket earns $8.40 an hour. How much would he earn in 48 hours? _____
4. 20% of Martha's weekly paycheck goes to taxes. Last week she paid $36 in taxes. What was her gross weekly salary? _____
5. John makes a 15% profit on each $18.00 magazine subscription he sells. How many subscriptions must he sell to earn $229.50 needed to purchase a TV? _____
6. If a six-pack of soda pop sells for $3.30, how much does a single can cost? _____
7. The sale price of a loaf of bread was 58¢. If this price represents a ⅓ discount, what is the regular price of the bread? _____
8. What change would you receive if you purchased a $2.35 pad of paper with a 5 dollar bill? _____

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UNIT TWO:
THE TRACK MEET

Do you know:

How your body reacts to physical exertion?

A classification system for sorting the events at a track meet?

Pacing is a mathematics concept?

The track meet is a good place to discover how mathematics influences human performance. Mathematics allows athletes to measure and record their performances and their bodily reactions to these performances. Mathematics provides many clues for effective training techniques, as well as strategies for competition.

Discuss the following questions with your classmates. Record your responses in the spaces provided.

What information would a sprinter record that might help him increase speed?

_____

_____

_____

What strategies might teams or individual athletes use to increase competitiveness?

_____

_____

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Measuring Your Pulse and Respiration

It is important to understand how your body responds to physical exertion. When you physically exert yourself, your body responds in two ways to attempt to maintain a balance of oxygen in your body. Your heart beats more rapidly, thus pushing oxygen-rich blood to all parts of your body. You also breathe more rapidly, thus forcing greater amounts of oxygen into your lungs.

Locate your pulse at the pressure point on your neck just below your jaw. Count your pulse for a 10-second period. Calculate your pulse rate per minute by multiplying the rate for 10 seconds by 6 (10 seconds × 6 = 60 seconds).

1. Take and record your "at rest" pulse rate. _____
2. Perform one minute of vigorous exercise. Take and record your pulse rate after exercise. _____
3. Take and record your pulse at one-minute intervals until your pulse rate returns to your "at rest" rate.
4. Follow this same procedure for your respiration rate. Record your information on the chart below and on the graphs on the following page.

	Pulse Rate beats/min.	Respiration Rate breaths/min.
at rest		
after exercise		
after 1 minute		
after 2 minutes		
after 3 minutes		
after 4 minutes		
after 5 minutes		

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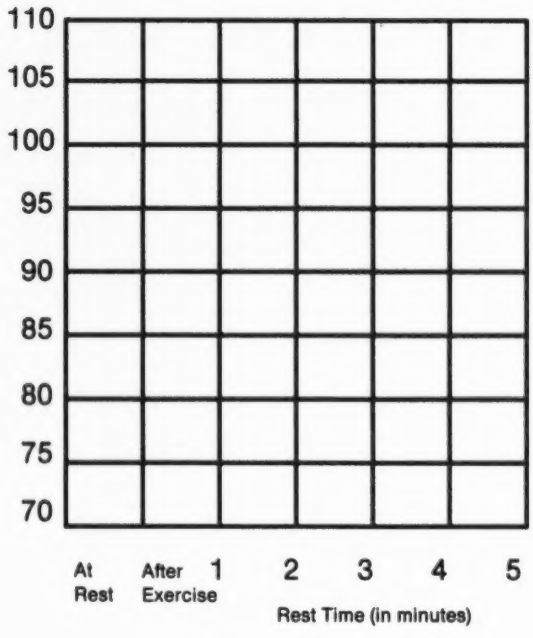
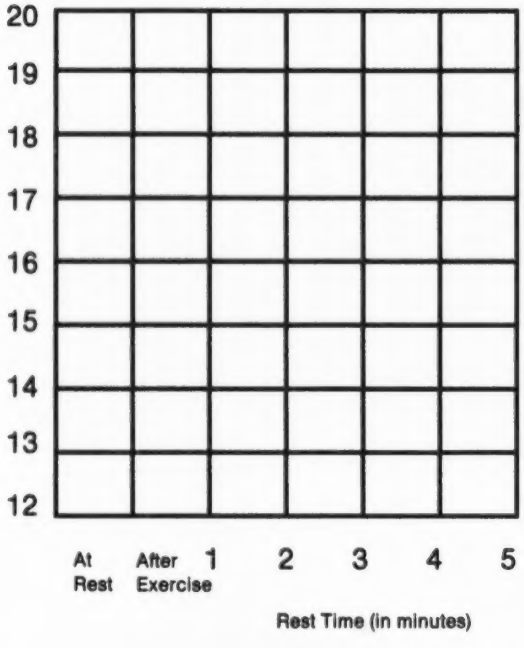
PULSE RATE



RESPIRATION RATE



When healthy, your body recovers from physical exertion within a short period of time—about 3 or 4 minutes after strenuous exercise. What does the above information tell you about your physical conditioning?

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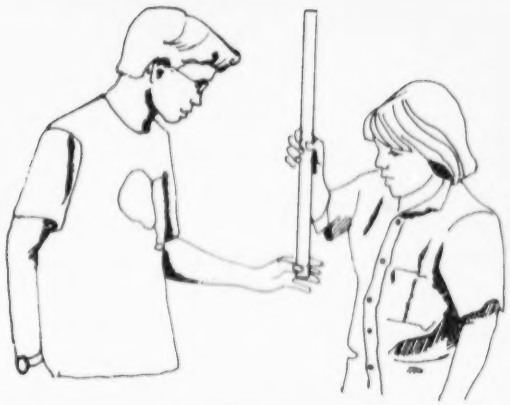
Reaction Time



The shorter the race, the more important it is for a sprinter to demonstrate quickness. One activity that a sprinter might work into his/her training schedule is the measurement of *reaction time*.

Try this experiment.

Ask a classmate to hold a meterstick between your thumb and forefinger. Your two fingers should be spread approximately 3 inches apart, and the meterstick should be held so that the zero centimeter point on the stick is even with your fingers.

Ask your classmate to release the meterstick at his/her discretion. Your task is to react to the falling meterstick as quickly as possible by catching it between your two fingers. Measure your reaction time by recording the number of centimeters that slipped through your fingers.

REACTION TIME	
Trial	Drop of Stick (cm)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Record a series of ten responses on the chart. Determine your average reaction time by dividing the total centimeters that slip through your fingers by 10. Answer the questions regarding this investigation.

Average Reaction Time: _____

Did your reaction improve with practice?

_____

How does anticipation affect your performance?

_____

Is your reaction time better when you use your dominant hand?

_____

Does hand strength affect reaction time? _____

What training program would you suggest for a sprinter who wants to improve his/her reaction time? _____

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Determining the Lineup

A track coach tries to have the best athletes entered in each event, but this is often not possible. There are a number of considerations a coach must make in maximizing the team's chances of winning the meet.

1. Usually an athlete may only enter three events during a one-day track meet.
2. An athlete can generally be expected to perform within 1 percent of his/her previous best performance on the first event entered; 2 percent of his/her previous best performance on the second event; and 5 percent of his/her previous best performance in the third event.
3. An athlete suffering an illness or injury during the week prior to a meet can expect only a 50 percent chance of finishing in the top three places.
4. "Rookies" (first-year performers) are much more likely to "clutch" (do poorer than expected) than experienced athletes. Rookies exceed their previous best performances only 10 percent of the time.
5. Some athletes are more affected by poor weather conditions than others. Generally, the older, experienced athletes are less likely to be adversely affected by poor weather conditions than younger, inexperienced athletes.

Below are the notes made by the track coach during practices one week prior to a meet.

Lu had flu early in week. Missed three practices.
Fred has sore arm. He's been to therapy.
Wilson rarely tires no matter how many events he enters.
Sammy brings out the best in his teammates.
Murray runs poorly on wet track.
Arthur works hard. He needs much encouragement.
Terry tires after one event.
Jim runs well in cold and rainy weather.
Arthur improves each day.
Brad seems to have peaked earlier in the season.
There is little chance that any of our athletes can take first place in the 200-meter dash this weekend.

Weather forecast: continued cold with 60 percent chance of rain.

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Below are the times and distances of the previous best performances of team members.

Name of Athlete	Yrs. on Team	Running Events (sec.)					Field Events (ft.)		
		100 yards	220 yards	440 yards	880 yards	one mile	high jump	shot put	long jump
Jerry	3	11.8	25.5	56.0	135	320.5	3'6"	9'6"	12'2"
Jim	4	11.2	24.8	54.8	128	334.0	—	11'5"	—
Sammy	4	11.5	24.6	49.9	—	345.0	3'11"	10'0"	15'6"
Lu	1	10.8	24.2	50.6	—	—	—	12'10"	—
Martin	4	—	—	—	124	305.8	—	—	15'8"
Terry	3	10.6	23.8	51.5	—	—	4'6"	13'0"	—
Manny	1	12.0	25.5	54.6	125	308.8	4'2"	—	13'4"
Wilson	2	11.5	25.1	50.2	130	312.7	4'10"	12'0"	14'9"
Arthur	4	10.9	25.0	58.0	145	356.8	5'0"	12'10"	—
Fred	4	—	—	—	—	—	—	—	15'1"
Murray	1	11.0	24.6	50.5	132	—	5'2"	11'8"	—
Brad	2	10.9	24.2	—	122	306.2	4'3"	12'4"	16'5"

The coach also has his own personal credo. "All who practice will participate." Help the coach decide which athletes will enter each event so that the team has the greatest chance for success. You may enter up to three athletes in each event. Be prepared to defend your decisions.

100-yard dash	_____	_____	_____
220-yard dash	_____	_____	_____
440-yard dash	_____	_____	_____
880-yard run	_____	_____	_____
1-mile run	_____	_____	_____
high jump	_____	_____	_____
shot put	_____	_____	_____
long jump	_____	_____	_____

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GA1071

Group Problem Solving

Use the following guidelines for group problem solving:

1. Your group should have 2 to 4 members.
2. Each group member is responsible for his own behavior.
3. Before asking for help, be sure each group member agrees on the question.
4. Each group member must agree on the solution to the problem.

Discover the pattern in the description below. Assume that the pattern holds true for the entire distance of the relay race.

The Relay

Every year at Philadelphia Stadium, the fastest relay teams in the nation meet to attempt to break the world record for the 150-mile run. This year the four members of the Striders relay team devised an unusual strategy to win the race.

The first of the four runners ran the first mile in exactly 5:00 minutes; the second runner ran the second mile in 5:01; the third runner ran the third mile in 5:02; and the fourth runner ran the fourth mile in 5:03, and so on.

Every time the fourth member of the team completed a mile, all four team members huddled together, slapped each other on the back, and sang one chorus of their school song. This ritual took exactly one minute each time. Following this pattern, how long did it take the Striders to run the 150 miles? Use the space below to solve the problem.

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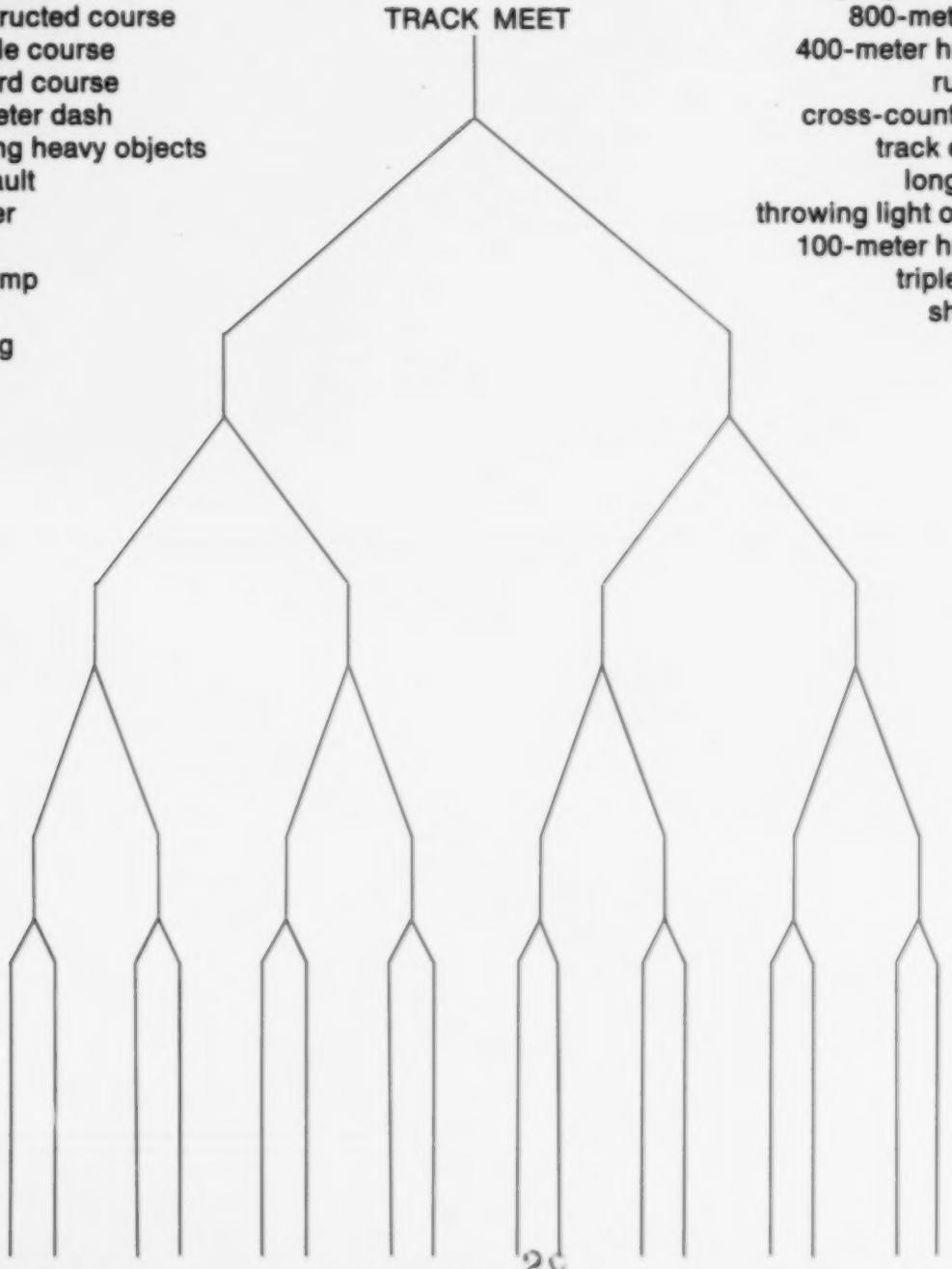
Sorting and Classifying

A sorting tree is used to classify objects into smaller and smaller groups. A sorting tree can help you distinguish the different events at a track meet by making a diagram of successive sorting. Write the characteristics of a track meet listed below on the proper branch of the sorting tree.

1600-meter run
sprinting
200-meter dash
field events
unobstructed course
obstacle course
standard course
100-meter dash
throwing heavy objects
pole vault
hammer
javelin
high jump
discus
jumping

steeplechase
jump for distance
changing course
jump for height
800-meter run
400-meter hurdles
running
cross-country run
track events
long jump
throwing light objects
100-meter hurdles
triple jump
shot put



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Diagramming

A line diagram can often help you visualize the elements of a problem.

Bill, Jill, Phil, Dill, Lil, and Gil all ran in the finals of the 400-meter dash. As the tape was broken by the winner, the following conditions existed:

1. Bill was 30 meters behind Jill.
2. Jill was 20 meters ahead of Phil.
3. Dill was 5 meters behind Bill.
4. Phil was 35 meters behind Gil.
5. Gil was 10 meters ahead of Lil.

Use the line diagrams to plot each of the clues.

1. Jill _____ Bill _____

| -------30 m------- |

2. Jill _____ Bill _____

| |

3. Jill _____ Bill _____

| |

4. Jill _____ Bill _____

| |

5. Jill _____ Bill _____

| |

What was the order of finish of all the runners?

_____

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Winning the Decathlon

Many people would say that the person compiling the most points in a world decathlon deserves the title of best athlete of the year.

The decathlon has ten different athletic events. In each event, points are awarded for each athlete's performance. After all ten events, the points are totaled and a winner is determined.

Below are the scores of the three best athletes in the decathlon. Assign points for each score by referring to the chart on the next page.

Decathlon Event	NAME OF ATHLETE					
	MARIA		JOSÉ		GREG	
		POINTS		POINTS		POINTS
1. 100-meter dash	12.9s		13.6s		14.0s	
2. 400-meter dash	58.2s		55.6s		56.8s	
3. 1500-meter run	5:30		5:12		5:23	
4. 110-meter hurdle	17.8s		18.9s		20.6s	
5. shot put	7.5m		10.2m		12.0m	
6. discus throw	26.9m		29.6m		33.2m	
7. javelin throw	29.0m		40.4m		38.2m	
8. long jump	5.5m		5.2m		4.7m	
9. high jump	1.5m		1.65m		1.4m	
10. pole vault	3.3m		2.6m		2.9m	
TOTAL POINTS						

Names of Winners: first place _____

second place _____

third place _____

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OFFICIAL POINTS ASSIGNED TO PLACE WINNERS OF DECATHLON EVENTS*

Event	Points 200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600
100 meter (sec.)	14.0	13.9	13.75	13.6	13.5	13.4	13.3	13.1	13.0	12.9	12.8	12.6	12.5	12.3	12.2	12.1	12.0
long jump (m)	3.9	4.0	4.1	4.3	4.4.	4.6	4.7	4.8	4.0	5.0	5.2	5.3	5.4	5.5	5.7	5.8	5.9
shot put (m)	6.0	6.4	6.8	7.2	7.5	7.9	8.3	8.6	9.0	9.4	9.8	10.2	10.5	10.9	11.3	11.7	12.0
high jump (m)	1.30	1.33	1.35	1.38	1.4	1.43	1.45	1.48	1.50	1.53	1.55	1.57	1.60	1.63	1.65	1.68	1.70
400 meter (sec.)	65.0	64.4	63.8	63.1	62.5	61.8	61.2	60.6	60.0	59.4	58.8	58.2	57.5	56.8	56.2	55.6	55.0
110 m hurdles (sec.)	22.2	21.9	21.5	21.3	21.1	20.9	20.6	20.3	20.0	19.7	19.5	19.2	18.9	18.7	18.4	18.1	17.8
discus (m)	15.4	16.7	17.9	18.8	20.5	21.8	23.0	24.3	25.6	26.9	28.1	29.6	30.7	32.2	33.2	34.6	35.8
pole vault (m)	1.6	1.7	1.8	1.9	2.0	2.1	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
javelin (m)	20.0	21.5	23.0	24.5	26.0	27.5	29.0	30.5	32.0	33.5	35.1	36.6	38.2	40.4	42.7	44.3	47.5
1500 meter (sec.)	5:30	5:27	5:23	5:19	5:15	5:12	5:09	5:06	5:00	4:57	4:53	4:49	4:45	4:40	4:36	4:32	4:28

*Source: DECATHLON SCORING GUIDE

Answer the following questions:

1. Which athlete did best in the four track events? _____
2. What were the first place winner's best and worst track events? _____

   _____
3. Which field event had the closest scores? _____
4. Which athlete improved his/her speed with the distance of the track events? _____
5. Why is the Olympic decathlon winner considered the best athlete in the world?

   _____

   _____
6. Explain how it is possible to win the decathlon without taking first place in a single event.

   _____

   _____

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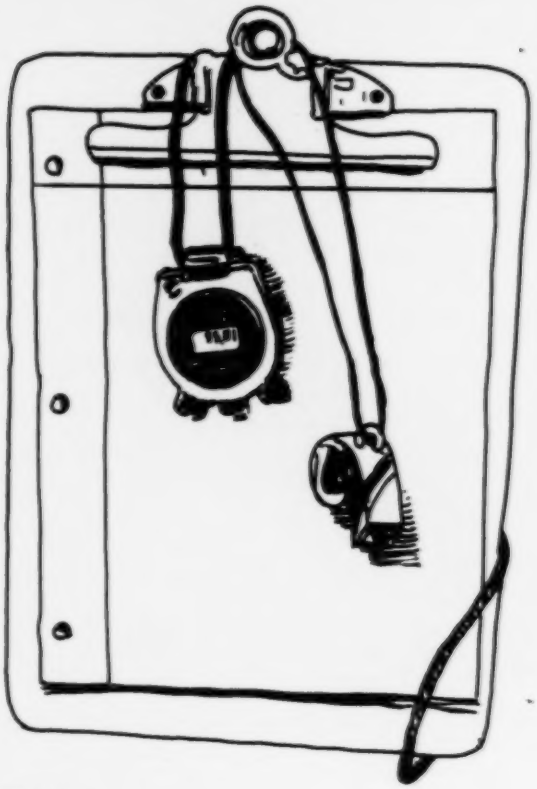
Trial and Error Strategies

When solving many problems, an initial guess at the solution can often be tested to see if it meets problem conditions. Subsequent guesses should systematically come closer to the correct answer. Try this strategy on the following problem. Use the space provided to solve the problem.

Coach "Speedy" Matthews began the track season by spending his $100 budget on stopwatches ($10.00 each), clipboards ($3.00 each), and plastic whistles (.50 each). There were 100 items in the order. How many stopwatches, clipboards and plastic whistles did Coach Matthews buy? Remember, he purchased 100 items for $100. Use the charts below to determine your answer.



TRIAL 1

Item	Number of Items	Total Cost
whistle		
clipboard		
stopwatch		
TOTAL		

TRIAL 2

Item	Number of Items	Total Cost
whistle		
clipboard		
stopwatch		
TOTAL		

TRIAL 3

Item	Number of Items	Total Cost
whistle		
clipboard		
stopwatch		
TOTAL		

TRIAL 4

Item	Number of Items	Total Cost
whistle		
clipboard		
stopwatch		
TOTAL		

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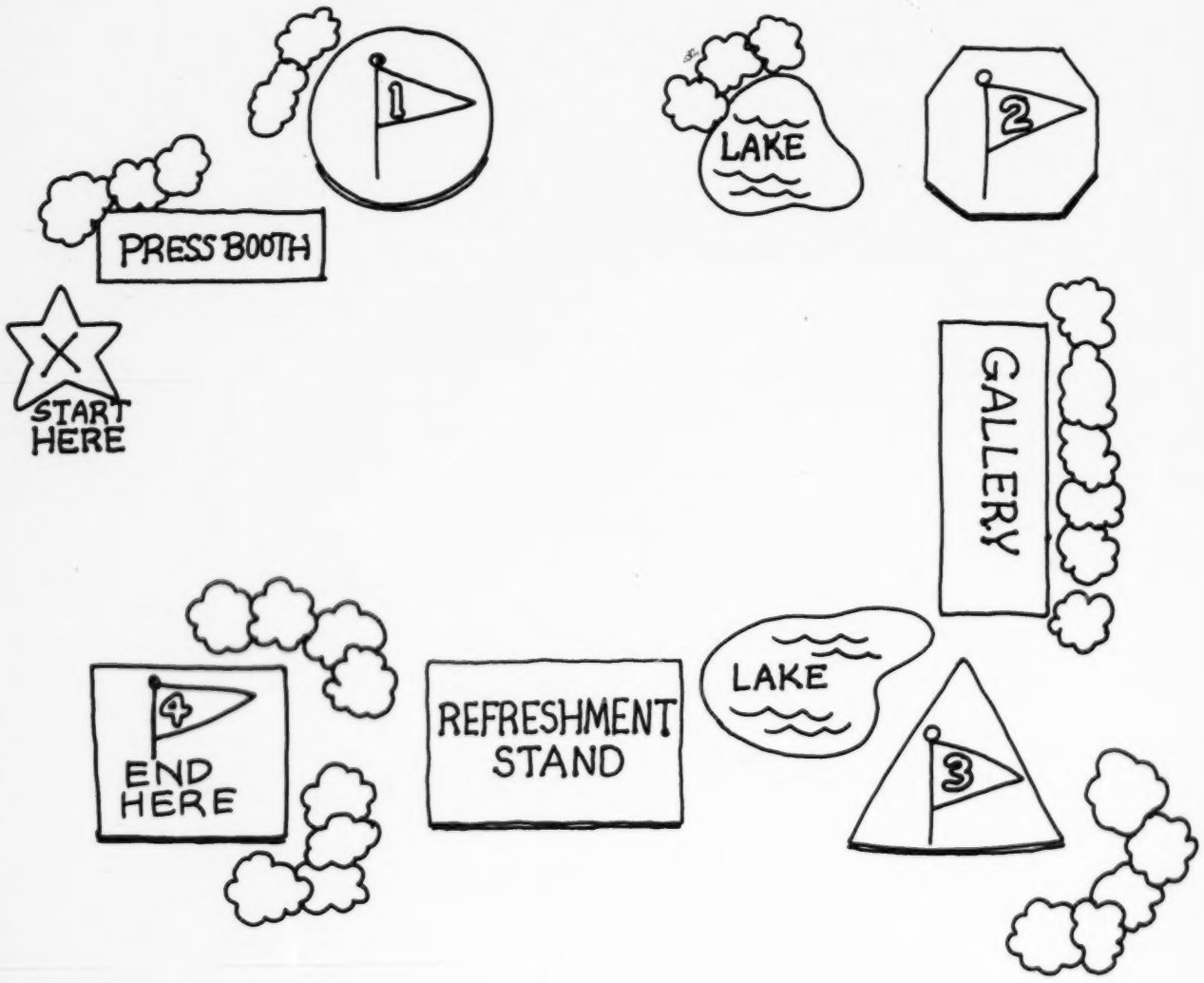
A Game: The Number Putt

Athletes often play other sports for relaxation and enjoyment. Play a game of golf in the space below.

The object of the game is to putt into each of the figures below. When it is your turn, roll three dice. The three numbers may be added, subtracted, multiplied or divided (or any combination of the four operations). The resulting computation is the number of centimeters you have "putted." A metric ruler should be used to draw a line segment the length of your number. On your next turn, draw another segment beginning at the end of your last line segment.

Each player must putt into each of the target areas (designated by geometric shapes) in any order. Putts may not land in spectator galleries, press booths or refreshment stands.



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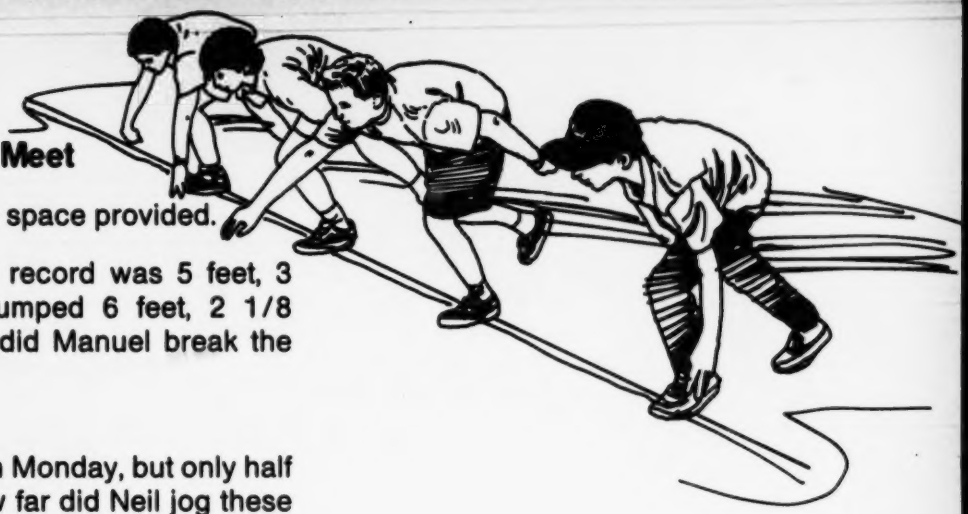

Problems at the Track Meet

Solve each problem in the space provided.

1. The school high jump record was 5 feet, 3 3/8 inches. Manuel jumped 6 feet, 2 1/8 inches. By how much did Manuel break the old record? _____

2. Neil jogged 2.6 miles on Monday, but only half as far on Tuesday. How far did Neil jog these two days? _____

3. The day after Jill bought her running shoes for $24.60, she saw a sign in the store window: "25% off all shoes." How much could Jill have saved if she had waited a day to buy her shoes? _____

4. The Striders won 4 of 5 meets this season. What was their percentage of wins? _____

5. Ronnie ran the 1500 meters in 5 minutes and 4 seconds. Reggie ran the same distance in 15 seconds less. What was Reggie's time for the 1500 meters? _____

6. Joan ran the 50-yard dash in 5 seconds. At this rate, what would be her time in the 220-yard dash? _____

7. The first leg of the 440-yard relay took 11.5 seconds. The second and third legs took 11.85 seconds. The anchor leg took 11 seconds flat. What was the total time for the 440-yard relay? _____

8. Jerry's slowest time in the 440-yard dash was 70 seconds. His best time was 15% faster. What was Jerry's best time? _____

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More Problems at the Track Meet

Solve each problem in the space provided.

1. Jim's best time in the 100-meter dash is 11.6 seconds. In a recent meet, Jim's time was 5% less than his former best. What was Jim's finishing time? _____

2. Jerry runs the 50-yard dash in 5 seconds. At this rate, how fast could he run the 220-yard dash? _____

3. On two consecutive days, Neil ran a total of 36 miles. He ran twice as far on the first day as he did on the second. How far did Neil run on the second day? _____

4. Jeremy bought a new sweat suit on sale at 1/3 off. If the original price was $45, what was the sale price? _____

5. The winning time for the four legs of the mile relay was 4 minutes and 40 seconds. What was the average time for each of the four runners? _____

6. The Striders lost 2/5 of their dual meets, or a total of 4 meets. How many track meets did they win? _____

7. In the first meet of the season, Sherry ran the 880-yard dash in 3 minutes, 5 seconds. In the last meet she ran the same race in 2 minutes, 28 seconds. How much faster was her second time than her first? _____

8. Manny placed second in the long jump with a leap of 17 feet, 4¼, inches. The winner jumped 2½ inches further. What was the winning jump? _____

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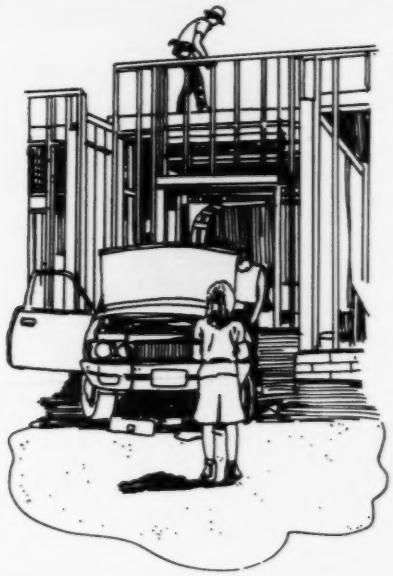
UNIT THREE:
THE CONSTRUCTION SITE



Do you know:

How tools help the construction worker?

What math skills are used frequently by construction workers?

If the construction site is a cooperative problem-solving effort?

How mathematics can be used to describe qualitative as well as quantitative relationships?

Mathematics is as much the language of the construction site as English. Precision at the construction site is conveyed by means of mathematics.

Read the two guides for assuring adequate electrical wiring in a house under construction.

Guide 1

To assure adequate wiring, the amount of electric power that each major appliance uses must be considered, as well as the size of the dwelling and the number of people who will live at this site.

Guide 2

The probable electrical load for a house is as follows:

Area of 2100 sq. ft. house	
X 3 watts	6300 watts
Two appliance circuits	3000 watts
One laundry circuit	1500 watts
Electric range	12,000 watts
Electric water heater	5000 watts
TOTAL	27,800 watts

What are the merits of both guides? _____

_____

Which guide would be most helpful to an electrician? Why?

_____

_____

Which guide would be most helpful to a home buyer? Why?

_____

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Surveying Workers

Interview a general contractor or job foreman to determine the math skills used by various construction workers. Record your findings with a check (✓) on the chart below.

Math Skills Used	Construction Site Workers			
	Electrician	Carpenter	Mason	Plumber
makes fraction computations				
uses calculators				
takes measurements				
figures percentages				
estimates				
finds averages				
uses formulas				
reads charts and diagrams				
uses statistics				
makes decimal computation				
uses geometric concepts				
solves math problems				

Record important comments from your interview in the space provided.

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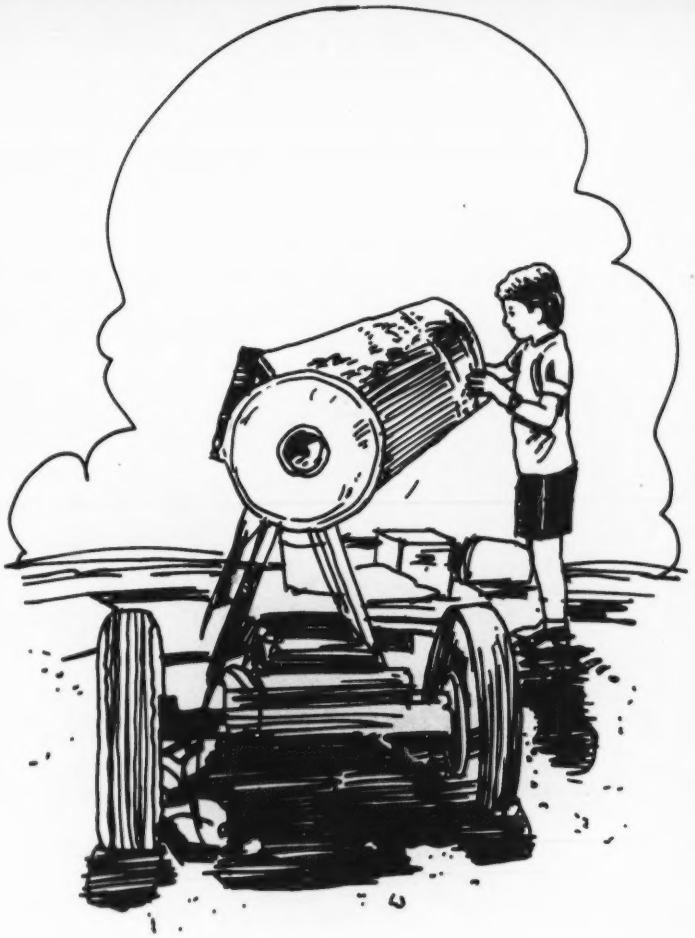
Making Concrete

Jerry is a mason at the construction site. A mason works with concrete and bricks to build walls, fireplaces, etc.

Jerry prepared to make his first batch of concrete. The proportions he uses never vary. He mixes 7 parts sand and 4 parts mortar with water. Jerry could not find his measuring bucket. The only containers he had were a five-gallon bucket and a three-gallon bucket.

Jerry is not only a fine mason, but he is an expert mathematician. Outline the steps Jerry used to make accurate measurements.



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Tools of the Trade

Match each construction worker with his specific tools. Then match each tool with its use. Ask a construction worker to visit your class and explain how various tools are used at the construction site.

CONSTRUCTION WORKER	TOOLS	USE OF TOOLS
plumber	float	fastening
	multimeter	
	crescent wrench	
	strap vise	
	plane	
	trowel	smoothing
	framing square	
	miter box	
	hacksaw	
electrician	tamp	measuring
	needle nose pliers	
	line clips	
	hammer	
	bevel	holding objects
	file	
	level	
	wire nuts	
	brace	fitting pieces together
carpenter	circular saw	
	putty knife	
	wheelbarrow	
	soldering iron	making holes
	drill	
	screwdriver	
	maul	
mason	shears	cutting
	surform	
	chisel	
	apron	
	plumb line	
	snips	
	toolbox	
	chalk line	

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Indirect Measurement: The Hypsometer

The hypsometer is used to measure the height of an object when standing a known distance from it. The hypsometer can also provide an estimate of the distance to an object if the height of the object is known or can be estimated.

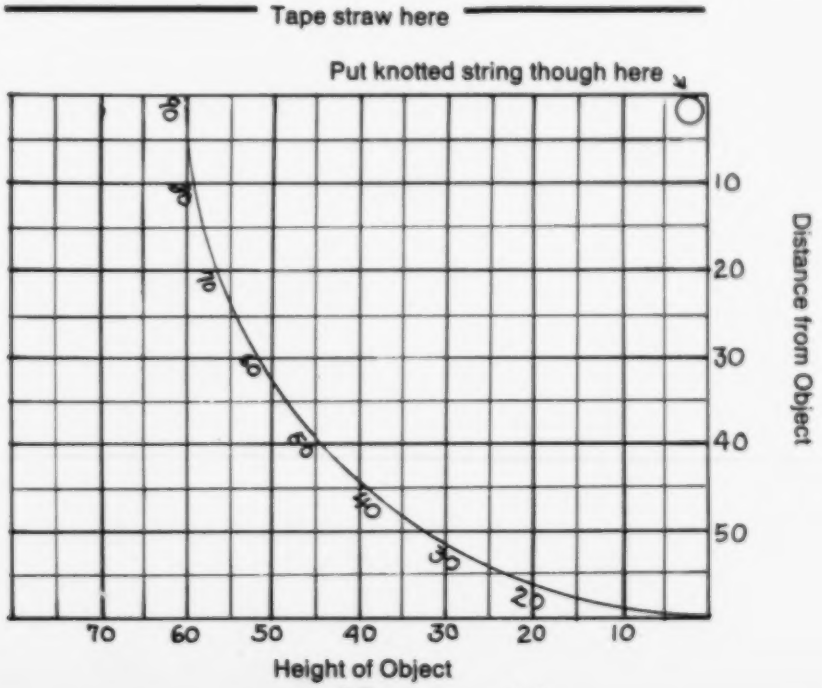
To Construct a Hypsometer:

Cut out the grid at the bottom of the page and glue it to a sheet of cardboard. Tape a drinking straw to the top of the cardboard as shown. Attach a weighted string to the upper right corner of the cardboard as indicated.

To Use a Hypsometer:

1. Measure the distance from the object to your standing position.
2. Sight the top of the object to be measured by looking through the drinking straw.
3. Note the position where the string passes through the height scale on the hypsometer.
4. Plot a line from the distance scale to the plumb line (string) and then down to the horizontal scale.
5. Read the height of the object along the bottom scale.
6. Demonstrate the proper use of a hypsometer by measuring the heights of several objects.

Hypsometer



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Writing Equations

Many word problems can be solved easily by translating the problem "wants" and "givens" to number sentences (equations). Elementary algebraic processes may then be used to solve the problem.

Practice translating the following word problems to number sentences. Study the example. Solve the problems.

Example:

Jerry worked 8 hours more overtime than Bill. Together they have worked 32 hours of overtime. How many overtime hours did both men work?

$J = B + 8$

$J + B = 32$

$(B + 8) + B = 32$

$2B + 8 = 32$

$2B = 32 - 8$

$B = \frac{32 - 8}{2}$

$B = 12$ hours

$J = 12 + 8$

$J = 20$ hours

1. If Ben works 2 more overtime hours, he will have worked twice as many hours as Sam, but still 3 hours less than Jim. If Jim worked 17 overtime hours, how many hours did both of the other men work?

2. In recent union elections, Jill received twice as many votes as Lee. Maria received 2 more votes than Lee. There were 34 total votes. How many votes did each candidate receive?

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Solving Sub Problems

Many complex problems can be solved by working a series of easier sub problems. In this strategy, focusing your attention on solving the simple sub problems allows the solution of these problems to suggest the process in solving the more complex problem. Look for and solve the sub problems in the following situation.

The All Electric Home

"Do you really think we need air-conditioning in our new house?" Fred McMiles asked his wife, Jenny, as they sat with the realtor of their new subdivision. "I hear air conditioners cost a lot of money to operate."

The realtor smiled. He had heard this same discussion many times before. "Folks," he interrupted. "Let's do an experiment that will help you make up your mind. Come with me." The realtor led the couple up the street to the model homes. They stopped in front of two identical homes except, as the realtor explained, one had air conditioning and the other did not.

The trio approached the electric meter of the home without air-conditioning. "This little dial goes around once for each ten-watt hours of electricity used," the realtor explained. "When it goes around a hundred times, you've used one hundred kilowatts of electricity. The same is true for the air-conditioned house," the realtor added as she pointed next door.

"Now for the experiment. Fred, you and Jenny go into this non-air-conditioned home and turn on all the lights. I'll go next door to the air-conditioned house and turn on all the lights and the air conditioner. Then we'll compare meter readings."

Jenny and Fred did as they were instructed and returned to the meter. The dial took ten seconds to go around once. Next door, the realtor did the same. "The dial took six seconds to go around once!" he called.

If electricity costs 7¢ per hundred kilowatt hours, how much will it cost to operate the air conditioner for 6 hours? Use a separate sheet of paper for your mathematical calculations.

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Cooperative Logic

Use the following guidelines for group problem solving:

1. Your group should have 4 members.
2. Each group member is responsible for his own behavior.
3. Before asking for help, be sure each group member agrees on the question.
4. Each group member must agree on the solution to the problem.

Procedure:

Cut out and distribute a clue card to each member of your group. The purpose is to find the two jobs for Beth, Dave and Lu in a cooperative manner. Group members may read aloud their clues but may not show their clues to other team members.

List the jobs for Beth, Dave and Lu. _____

_____

Problem: Find the two jobs of each person. Clues: • The people's names are Beth, Dave and Lu. • Dave owes the roofer some money.	Problem: Find the two jobs of each person. Clues: • The jobs are mason, electrician, carpenter, roofer, plumber and painter. • The carpenter married the painter's sister.
Problem: Find the two jobs of each person. Clues: • The painter had an argument with the electrician. • The carpenter laughed at the plumber's wet clothes.	Problem: Find the two jobs of each person. Clues: • Lu was at work on Monday before Dave and the painter. • Both the plumber and the roofer play cards with Beth.

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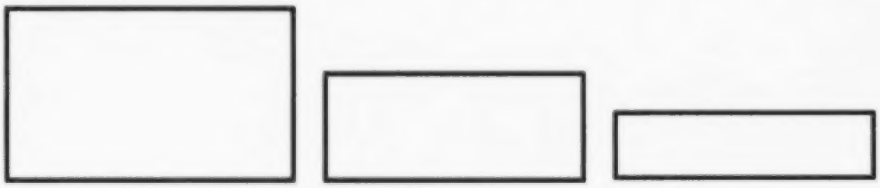
The Golden Rectangle

The ancient Greeks often used mathematical shapes to describe aesthetic beauty. One example was the golden rectangle.

Which of the following rectangles do people find most pleasing? Take a survey of your classmates. Tally the results of your survey under each figure. Total the tallies for each figure.



Tallies:

Total: _____ _____ _____

The length of a golden rectangle divided by its width is an irrational number which, when rounded to a single decimal place, is 1.6. Measure the rectangles. Put an X on the golden rectangle. Did your survey indicate that people found the golden rectangle to be the most aesthetically pleasing of the three rectangles?

_____

Measure pictures, postcards, wall surfaces, windows, etc., to find the golden rectangle ratio. List everyday objects as being examples of golden rectangles.

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

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Group Problem Solving

Use the following guidelines for group problem solving:

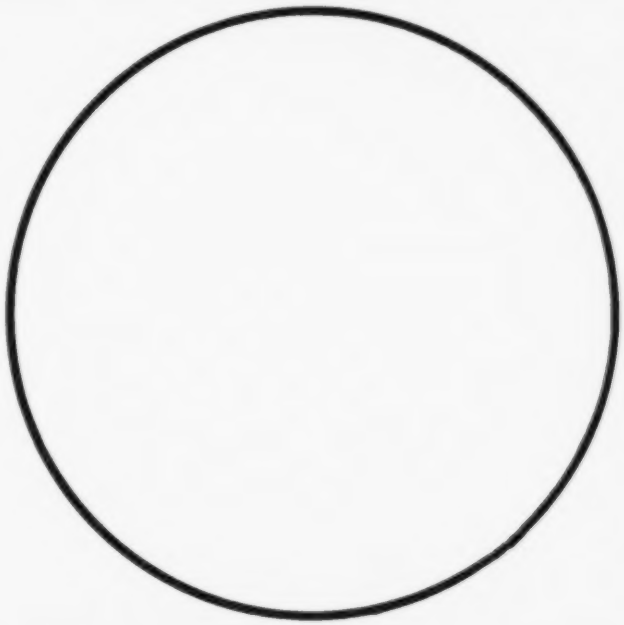
1. Your group should have 2 to 4 members.
2. Each group member is responsible for his own behavior.
3. Before asking for help, be sure each group member agrees on the question.
4. Each group member must agree on the solution to the problem.

The Commons

At the new Country Place Condominiums, a commons area is planned where residents may picnic, play or just relax. The commons area is a circular, grass-covered park large enough to accommodate many different group activities. The problem is, of course, to keep one activity from disrupting another. For example, the Frisbee throwing area should not interfere with the barbecue area.

A solution to the problem was offered by a landscape architect. He suggested that straight paths be built across the circular park, sectioning it into distinct areas.

"Fine!" said the developers. "We can think of 11 different group activities. What are the fewest straight-line paths that will give us 11 separate areas?" "Four paths," replied the architect.



1. Draw a diagram of the resulting commons area.

2. How many separate areas would the developers get if they doubled the number of paths from four to eight? _____

3. What if the developers tripled the number of paths?_____

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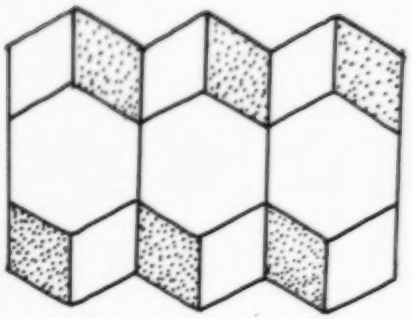
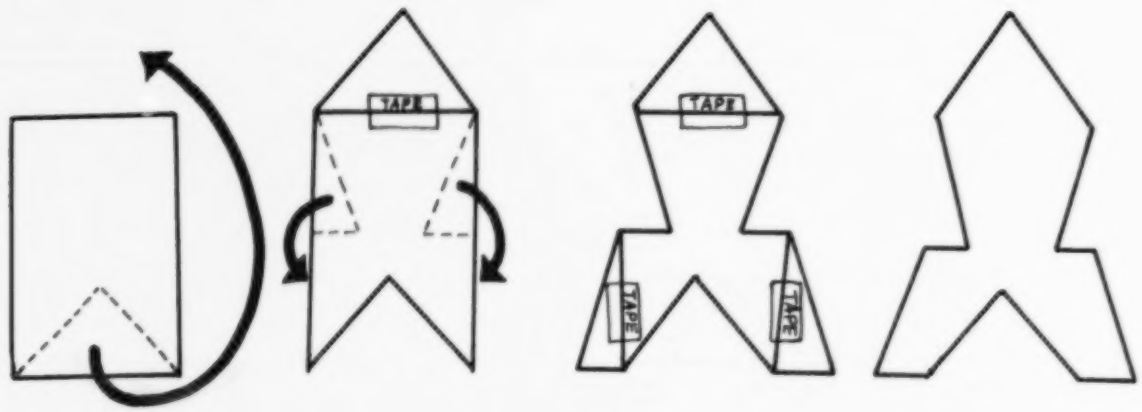
Cutting Tiles



Any shape can be used to tile a floor as long as there are no gaps or overlays. The square and the hexagon are common tile shapes. With a little patience, you can create your own tile shape.

The following example shows the step-by-step design for an unusually shaped tile. By starting with a simple polygon, such as a rectangle, square, parallelogram, hexagon or triangle, modifications can be made that produce unique tile shapes. Remember to add all pieces you remove from your original design.

Use a piece of tagboard to create a template of the tile designs below. Use this pattern to trace several copies of the designs on construction paper. Arrange the shapes so that they fit together.



Use a piece of tagboard to create your own unique tile shape. Use this sample as a template to produce as many paper copies as needed to cover a small area of your home or school. Draw the steps you took to make your unique design in the space below.

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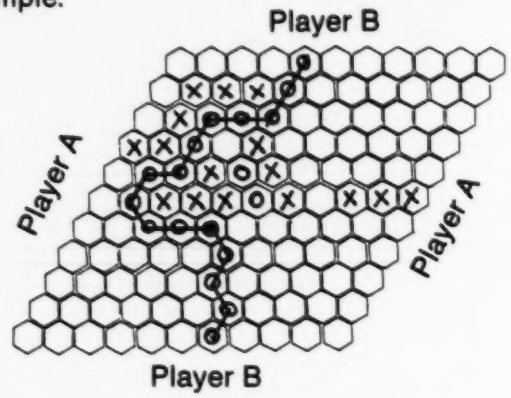
A Game: Hex Tiles

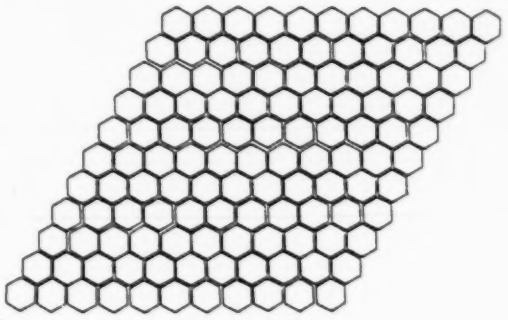
No one knows who invented the game of Hex Tiles. Perhaps it was two stonemasons who, while taking a break on a partially completed patio they were tiling, discovered an entertaining way to pass the time.

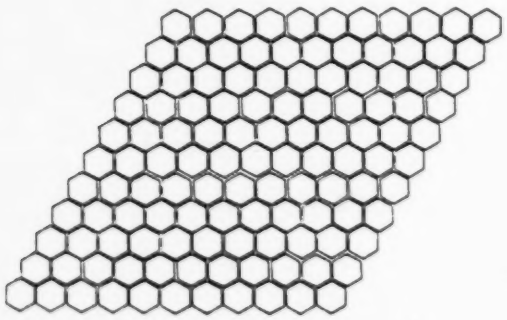
The game is simple. Both players, in turn, mark an X and an O on hexagonal tiles. The object of the game is to establish an unbroken chain of marked tiles. Player A attempts to establish a horizontal (side to side) chain. Player B attempts to make a vertical (up and down) chain. Naturally, there is strategy involved in blocking your opponent.

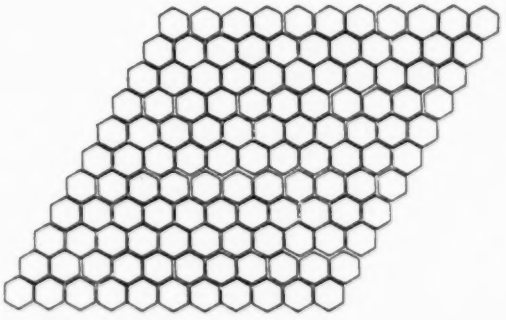
In the example below, the player using O's has won the game by completing an unbroken chain from side to side. The player using X's has been effectively blocked. Play Hex Tiles with a friend on the patterns below.

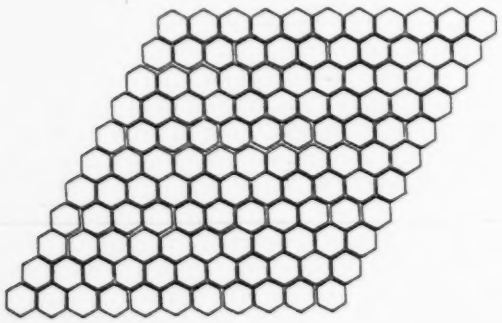
Example:

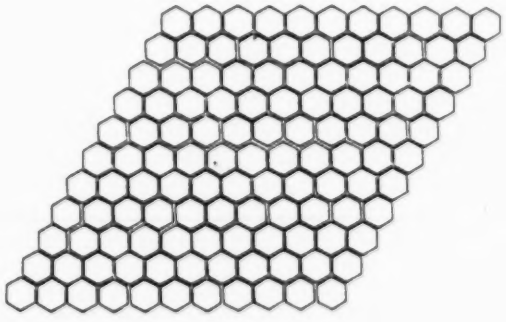












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Problems at the Construction Site

Solve each problem in the space provided.

1. What is the area of a rectangular house that is 16.3 meters wide and 27.5 meters long? _____

2. What is the perimeter of the house described in problem 1? _____

3. To add a room to her house, Louise borrowed $3000 from a bank. She must pay back the money in equal monthly installments over a two-year period. Total finance charges amount to $878.88. How much is each monthly payment? _____

4. A carpenter earns $17.00 per hour and works 35 hours a week. Deductions from his weekly paycheck amount to $38.00. What is his net pay? _____

5. A shade of paint can be obtained by mixing yellow with blue in the ratio of 2:3. How many gallons of blue paint are needed to mix with 6 gallons of yellow paint? _____

6. Two-thirds of Roberto's time on the job is spent on filling out the proper forms for ordering materials. If Roberto works 48 hours each week, how many hours are spent on completing forms? _____

7. Marsha wants to pour a concrete slab for a new garage. The slab will be 12 feet long, 20 feet wide and 6 inches thick. How many cubic feet of concrete must Marsha pour? _____

8. If Marsha orders 8 cubic yards of concrete to pour her garage floor, how much concrete will she have left over? (See problem 7.) _____

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More Problems at the Construction Site

Solve each problem in the space provided.

1. The concrete slab of a house under construction is 65½ feet long and 45½ feet wide. What is the area of the house? _____

2. How much fencing will it take to enclose a garden that is 15.6 feet long and 5.8 feet wide? _____

3. The monthly installments on a 5-year loan are $185. If the total amounts to $3500, how much money was borrowed? _____

4. An electrician earns $24 an hour. After paying deductions amounting to $275 a week, how much "take home" pay will he have after a 40-hour week? _____

5. The ratio of men to women employed by Bigway Construction Co. is 7:2. There are 24 women employed by the company. How many men are employed? _____

6. Three-fourths of the employees of Bigway Construction Co. are under 35 years of age. 14 people are 35 years old or older. How many people are employed by the company? _____

7. How many cubic inches are in a cubic foot? _____

8. How many cubic feet of concrete are needed to construct a sidewalk that is 30 feet long, 3 feet wide and 3 inches thick? _____

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UNIT FOUR:
THE SERVICE STATION

Do you know:

What skills are required to work at a service station?

What routine math problems must be solved every day?

How do mechanics get the parts they need to fix cars?

The service station serves as a training school for many young people who have an interest in mechanics and business. Mathematics is an important skill to develop in order to be a successful mechanic or business person.

What kind of mathematics is used by a mechanic?

_____

_____

What kind of mathematics is used by a small business person?

_____

_____

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Recognizing Impressions

Activity 1: FIRST IMPRESSIONS

Write a detailed description of what you think a typical work day might be like for a mechanic at a service station.

Activity 2: THE INTERVIEW

Invite a service station mechanic to visit your classroom. Ask this person to describe his/her typical work day. Ask questions that will help you gain insight into what specific skills or training are needed to work at a service station. Write a description of this person's work.

Activity 3: SECOND IMPRESSIONS

Now write a second description about a typical day in the life of a service station mechanic. Be sure your description is based on new information and attitudes acquired after talking firsthand with a mechanic.

Activity 4: DISCUSSION

Compare and contrast your teacher's and classmates' descriptions written in Activities 1 and 3. Discuss any changes in information and attitude with your teacher and classmates.

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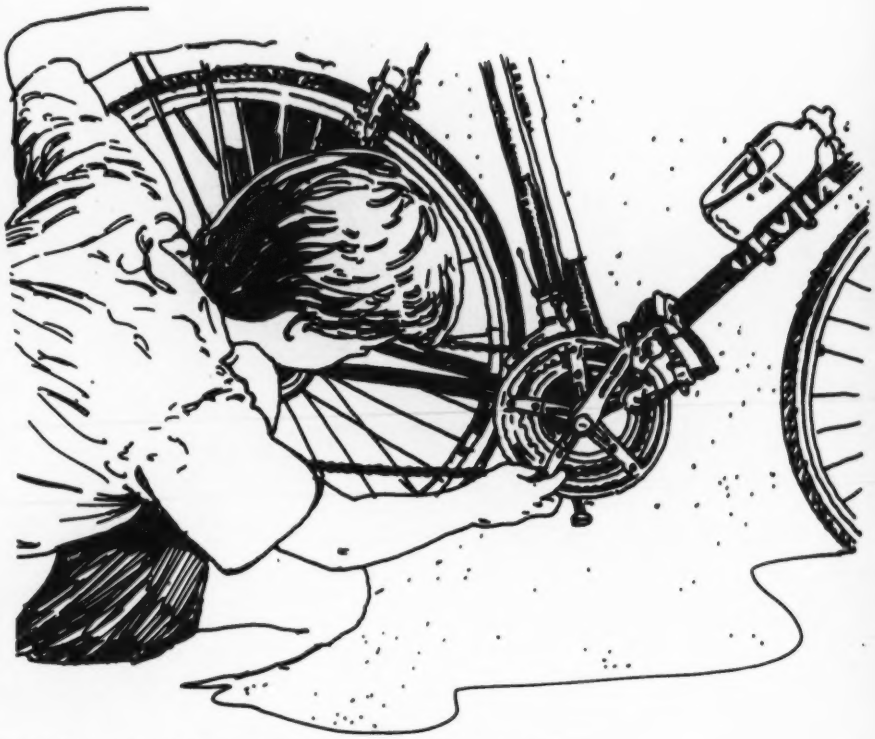
Observing Gears

Bicycle riders are frequent visitors to service stations. Most riders have had the experience of turning a bicycle over on its handle bars to change a tire or to oil the chain. The next time you have your bike in this position, determine how the number of pedal revolutions compare with the number of wheel revolutions.



Procedure:

1. Place a piece of masking tape on the rear tire of the bicycle.
2. Turn the foot pedal with your hand while a friend applies light pressure to the tire to keep it from moving too fast.
3. Count the number of pedal revolutions and the number of wheel revolutions.
4. Collect enough data to establish that a pattern exists. Record this information in the space below.

5. Count the number of teeth on the pedal gear and on the wheel gear. Record this information.

_____

6. Relate the number of teeth on the gears to the pattern determined by the wheel and pedal revolutions. State your conclusions from your observations and data collected.

_____

_____

7. Try this same inquiry on a multigeared bicycle. What conclusions can you make?

_____

_____

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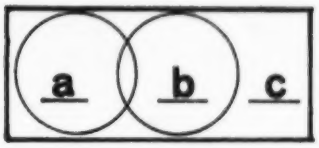
Sorting Circles

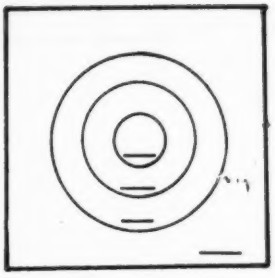
Logical reasoning is an important skill for people employed at a service station. Classify the objects according to important properties by placing the letter in the correct sorting area.

Example:



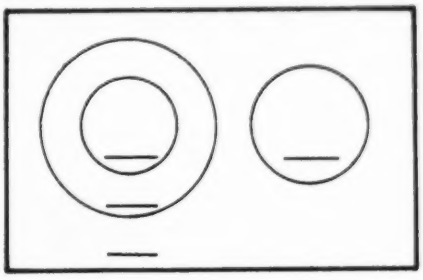
a. people who drive cars
b. people who drive trucks
c. drivers

1.



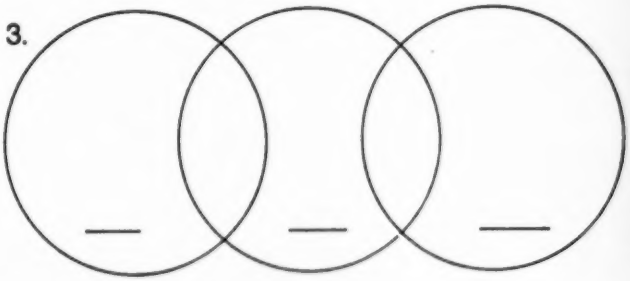
a. people who travel
b. drivers
c. people who ride in cars
d. people

2.



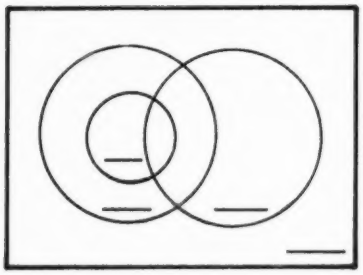
a. convertible
b. cars
c. trucks
d. transportation

3.



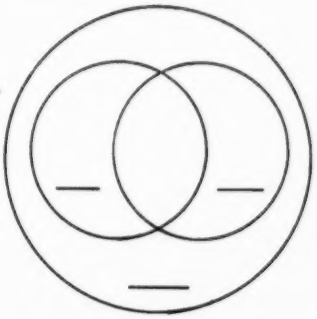
a. mechanics
b. men
c. sisters

4.



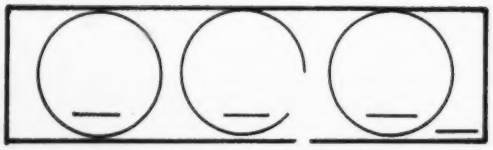
a. cars
b. red vehicles
c. cars in my town
d. vehicles

5.



a. gas station employees
b. mechanics
c. managers

6.



a. transportation
b. buses
c. automobiles
d. trains

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Using the Calculator

The use of the calculator has made computing mathematical equations quick and easy, but not error free. Instead of the mathematical mistakes generally associated with computation, most mistakes on calculators are the result of entry errors (such as pushing the 3 key instead of the 8). Because of the ease in making finger errors and the difficulty in detecting them, it is important to develop your estimating skills when using a calculator.

Estimate each answer before solving the problem with a calculator. If there is a large discrepancy between your estimate and calculated answer, repeat your calculation.

	Computation	Estimated Answer	Calculated Answer
1.	263 ÷ 36		
2.	3476 × .0045		
3.	34.67 × 3.78		
4.	3456.8 + 1005.5		
5.	1678.98 - 276.8		
6.	9765 ÷ 34.6		
7.	9.555 × 3.2		
8.	1.23 + 3.457 + 26		
9.	3 - .56		
10.	3547 + .99		
11.	2.33 × 36.89		
12.	2345 ÷ 2.3		
13.	13.2 + 23.45 + 10.666 + .355		

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Estimating Mathematics

It is helpful to have an idea of the answer to a problem before attempting to solve it. It is time well spent to begin every problem-solving task with an estimate of the solution to the problem.

Estimate the mathematics of the following situations.

1. the length of a string of 52 paper clips _____
2. the number of nails in a 1-pound box _____
3. the height of a four-story building _____
4. the number of people who live in a 250-apartment complex _____
5. the number of weekly overtime hours worked by the head mechanic _____
6. the weight of a screwdriver _____
7. the circumference of a fan belt in a car _____
8. the width of a double car garage door _____
9. the number of cars going your opposite direction on a busy expressway in ten seconds _____
10. the length of time of the yellow light on a stoplight _____
11. the cost to fill the tank of your car _____
12. the number of gallons used on an 8-hour trip on the interstate _____
13. the cost of a new pickup truck _____
14. _____

_____

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Finding Directions

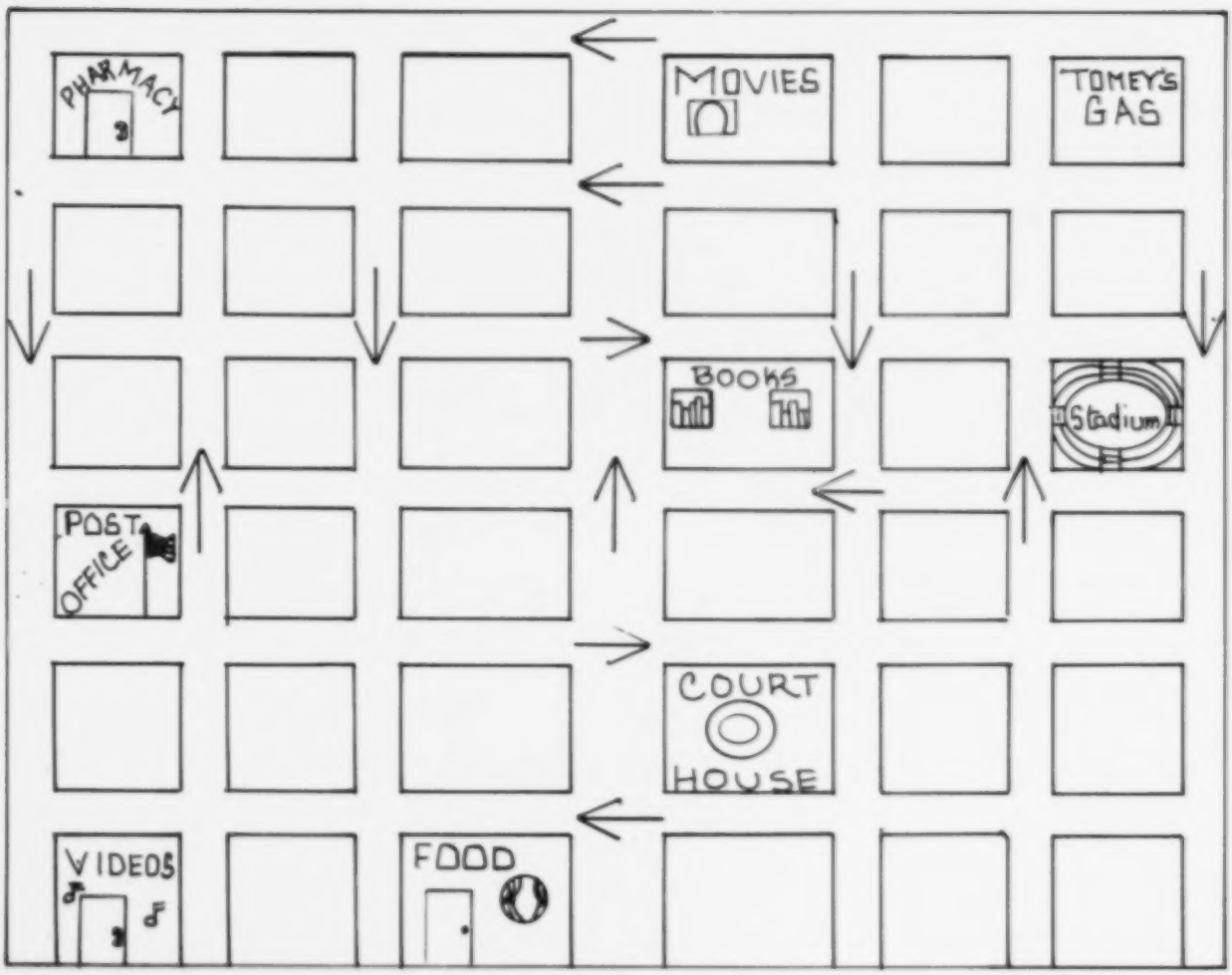
"This is the craziest city I've ever driven in," complained the tourist to Bill Tomey, owner of Tomey's Service Station. "I've never seen so many one-way streets. All I want to do is mail a letter at the post office, but I don't think there's a way to get there."

"Oh, there are plenty of ways to get there," replied Mr. Tomey. "You can make a left at the pharmacy, or you can drive down to the movie theater, make a left, and then a right when you get to the bookstore. Or, you can go down to the stadium and make a right. Or, you can . . . "

"Hold it! Hold it!" interrupted the tourist. "Just how many ways are there to get to the post office?"

Activity:

Find the different ways to get from Tomey's Service Station to the post office. Indicate the routes on the map below. Record the total number of routes.



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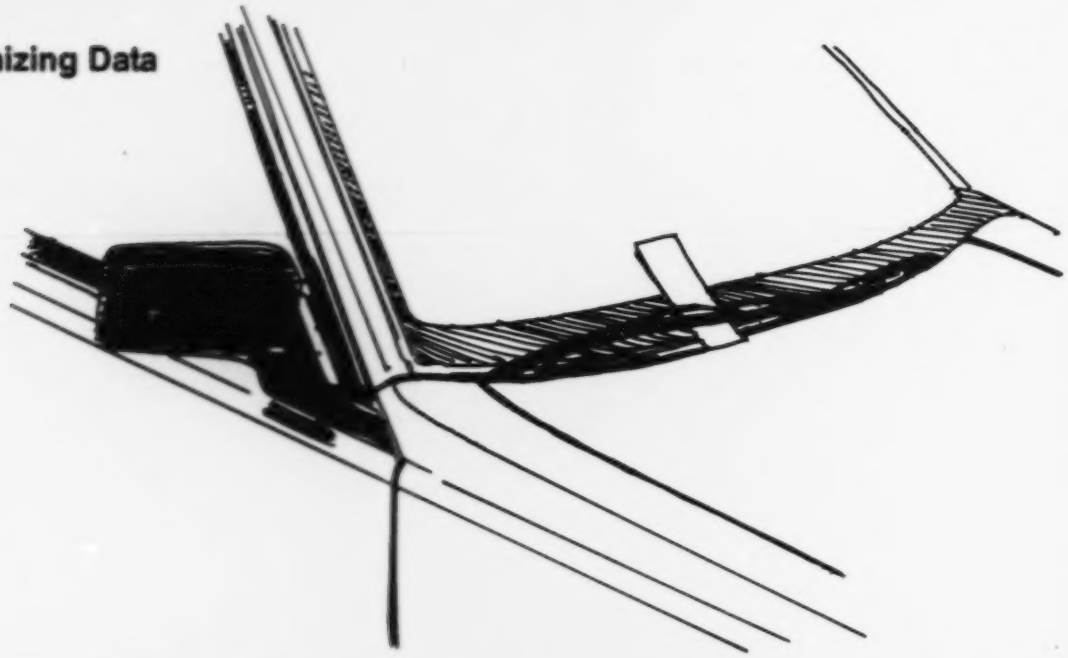

In solving problems, combinations of problem situations become so complex that some form of listing is necessary. Listing simple variants of a problem in a table makes discovering a pattern possible. Organize the data in the following problem in table form.

Rationing Gasoline

At the height of the energy crisis, 100 drivers waited patiently in the gas line of Tomey's Service Station. Bill Tomey recognized the problem. With the decrease in supply, many drivers waiting in line would not receive the gas they needed. Mr. Tomey needed an equitable way to distribute the gasoline. His idea was this: place a green sticker on the windshield of the first car in line, skip the next car, and place a green sticker on the third car. In this way, every other car in line would have a green sticker and these drivers would receive gasoline on a particular day.

This was fine until an unlucky driver in a car without a green sticker figured out what was going on. This driver went to the third car, took the green sticker, and put it on his own car, which was sixth in line. For good measure the driver continued down the line of cars, placing a green sticker on every third car if it didn't have one and taking a sticker from every third car that did.

It wasn't long before the fourth driver in line placed a green sticker on her car and then continued down the line changing the status of every fourth car in line. You can imagine what happened next. The fifth driver changed the status of every fifth car, a sixth driver changed the status of every sixth car and so on, until all one hundred drivers had taken a turn walking the line and changing the status of various cars.

Make a chart to help you find a pattern that will tell you how many drivers received gas this first day.

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Constructing Logic Puzzles

Logic puzzles are as much fun to create as they are to solve. Follow the directions to create your own logic puzzle.

1. Determining Categories. Describe and chart the three categories you wish to use in your puzzle in a manner similar to the sample puzzle below.

SAMPLE LOGIC PUZZLE

Category 1: employees at Tomey's Service Station

Category 2: jobs of employees

Category 3: cars driven by employees

MY LOGIC PUZZLE

Category 1: _____

_____

Category 2: _____

_____

Category 3: _____

_____

EMPLOYEES		JOB		CAR	
Beth	A	attendant	B	van	C
Bill	D	manager	E	truck	F
Manny	G	mechanic	H	convertible	I
Sam	J	cashier	K	sports car	L

A	B	C
D	E	F
G	H	I
J	K	L

2. State Introduction. Use your chart to write the introduction to your puzzle, which includes the problem "wants."

Introduction: Each of the four employees at Tomey's Service Station has a specific job and drives a different type of vehicle. Match the employee with his/her job and vehicle.

Introduction: _____

_____

_____

_____

3. Develop Clue Statements. Write clue statements using items from your chart of categories. Each statement should connect two items in the chart. Every item should be used at least once.

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Clues:

a. Sam drives a sports car (J,L).

b. Beth works at full service (A,B).

c. Bill does not like vans (D,C).

d. The manager drives a truck (E,F).

e. The cashier is not Manny (G,K).

f. The mechanic drives a convertible (H,I).

g. Manny dislikes trucks (G,F).

Clues:

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

4. Make Solution Chart. Make a solution chart for the puzzle. Use the clue statements to fill in the chart. Write Y for "yes" if the clue describes a match. Write N for "no" if the clue does not describe a match.

gas attendant	Y			
manager				
mechanic				
cashier			N	
van		N		
truck			N	
sports car				Y
convertible				
	Beth	Bill	Manny	Sam

5. Draw Logical Conclusions. Study the solution chart. Draw conclusions from this information you have collected.

a. Beth is the gas attendant and drives a van.

a. _____

b. Bill is the manager and drives a truck.

b. _____

c. Manny is the mechanic and drives the convertible.

c. _____

d. Sam is the cashier and drives a sports car.

d. _____

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Stacking Change

It was a slow day at the service station. Sam, the cashier, was bored, so he began to play with the money in the cash register. Sam stacked four coins as follows:

dime
nickel
quarter
half dollar

After stacking the coins from the largest in size to the smallest, with the largest coin on the bottom, Sam tried to move the entire stack to another circle, one coin at a time. But there was a catch: a larger sized coin can never rest on top of a smaller one.

What are the fewest number of moves it will take to move all four coins? Hint: Work the problem with a fewer number of coins and look for a pattern.

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Problems at the Service Station

Solve each problem in the space provided.

1. The "highway m.p.g." is 25. If gasoline costs $1.05 per gallon, about how much will it cost to drive 2250 miles? _____

2. A car travels 2186 miles on 95 gallons of gas. Find its fuel economy or the number of miles per gallon it travels. _____

3. A gas station attendant works 40 hours a week and earns $4.50 per hour. Deductions from his paycheck amount to $36.00 per week. What is his net pay? _____

4. On a map, 1 cm represents 50 km. What is the distance between two towns that are 6.5 cm apart on the map? _____

5. Some service stations offer 3% discounts to customers who pay in cash. If you pump $12.50 into your tank, how much will it cost if you pay in cash? _____

6. Before leaving on a trip, your odometer reads 35,457 miles. Upon reaching your destination, your odometer reads 36,645 miles. Gasoline receipts indicate that you used 62 gallons of gas on the trip. How many miles did you travel per gallon of gas? _____

7. Beth knows that each of her tires should hold 32 p.s.i. (pounds per square inch). Over a 24-hour period, she noted that the pressure in one tire dropped to 24 pounds. What percentage of the air was lost from the tire? _____

8. If Manny drives half the distance of an errand at 40 m.p.h. and half at 30 m.p.h., how many minutes will it take him to drive 24 miles? _____

62

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More Problems at the Service Station

Solve each problem in the space provided.

1. When a car travels 216 miles on 18 gallons of gas in the city, what is its "city m.p.g." (miles per gallon) rating? _____

2. If 1 cm on a map represents 18 km, how far apart on the map are two cities that are actually 432 km apart? _____

3. Every week Manny, the mechanic, has $85 deducted from his paycheck. What is his net income for 48 hours work if his hourly wage is $24.50? _____

4. Gas is $1.08 a gallon. If a car's "city m.p.g." is 14, how much will it cost to drive 365 miles in the city? _____

5. If you pay for gasoline with a credit card, you are charged an additional 3%. How much will it actually cost to charge $14.20 of gas? _____

6. Bill filled his 15-gallon gas tank before starting his trip. After driving 235.6 miles, he again filled his tank with 12 gallons of gas. How many miles did Bill travel on one gallon of gas? _____

7. If Sam drives 45 miles per hour, how long will it take him to drive 48 miles? _____

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Answer Key

UNIT ONE: THE CORNER STORE

Page 1: Answers will vary.

Page 2: Answers may include: Retail stores obtain merchandise by making it, buying it wholesale, or selling it on commission. The cost of the item plus the profit margin determine the selling price. The cost of merchandise, overhead expenses, advertising, and salaries are some operational expenses.

Pages 3-4: Answers will vary.

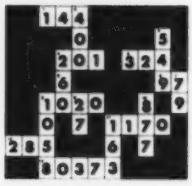
Page 5: Answers will vary.

Page 6: 99 tables. Answers will vary.

Page 7:
1.a. Information needed: the number of votes each person received. Answer: 234 votes were cast.
2.a. Information needed: J received the fewest votes. Answer: 36 votes
1.b. Information needed: the total number of stamps minus the American stamps. Answers: 998 stamps
2.b. Information needed: the total number of stamps minus the sum of the American and Mexican stamps. Answer: 351 Canadian stamps

Page 8: Answers will vary.

Page 9:



Page 11:

Description	Income	Expenses	Account Balance
CD's		$105.00	
Videotapes		80.50	
Records		40.00	
Advertising		325.00	
Electric		85.27	
Telephone		26.79	
Payroll		420.00	
Payroll		210.00	
		250.00	
		52.00	
Cash Sales	$964.11		
Charge Sales	691.81		
Returns		198.18	

1. $1655.92
2. $1792.74
3. <$136.82>

Page 12: 50¢

Page 13: Answers will vary.

Page 14:

1. $9.45	5. 38 watches
2. $4.36	6. 65¢
3. 90¢	7. $600.00
4. $14.00	8. $4.20

Page 15:

1. $27.20	5. 85 subscriptions
2. 59¢	6. 55¢
3. $403.20	7. 87¢
4. $180	8. $2.65

UNIT TWO: THE TRACK MEET

Page 16: Answers will vary.

Pages 17-18: Answers will vary.

Page 19: Answers will vary.

Page 21: Answers will vary.

Page 22: 16 hours, 14 minutes, 55 seconds

Page 23:

Page 24: Gill, Lil, Jill, Phil, Bill, Dill

Page 25:

2nd Maria	1st José	3rd Greg
425	275	200
475	575	525
200	325	250
600	500	350
300	475	600
425	475	550
350	525	500
525	450	350
400	550	300
600	425	500
4300 pts.	4575 pts.	4125 pts.

Page 26:

1. Maria	4. None
2.100 m dash (worst) 400 m dash (best)	5. Answers will vary.
3. Javelin throw	6. Answers will vary.

Page 27:
94 whistles, 5 stopwatches and 1 clipboard

Page 28: Answers will vary.

Page 29:

1. 10¾ inches	5. 4 minutes 49 seconds
2. 3.9 miles	6. 22 seconds
3. $6.15	7. 46.2 seconds
4. 80%	8. 59.5 seconds

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Page 30:

1. 11.02 seconds
2. 22 seconds
3. 12 miles
4. $30.02
5. 1 minute 10 seconds
6. 6 meets
7. 37 seconds
8. 17 feet 6¾ inches

UNIT THREE: THE CONSTRUCTION SITE

Page 31: Answers will vary.

Page 32: Answers will vary.

Page 33: Answers will vary.

Page 34: Answers will vary.

Page 35: Answers will vary.

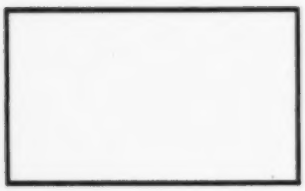
Page 36:

1. Ben worked 12 hours.
   Sam worked 7 hours.
2. Lee got 8 votes.
   Jill got 16 votes.
   Maria got 10 votes.

Page 37:
approximately $1.01

Page 38:
Beth, mason and painter
Dave, plumber and electrician
Lu, carpenter and roofer

Page 39:



Larger rectangle is the golden rectangle.

Page 40:
1.

2. 37 areas
3. 78 areas

Page 41: Answers will vary.

Page 42: Answers will vary.

Page 43:

1. 448.25 square meters
2. 87.6 meters
3. $161.62
4. $557.00
5. 9 gallons
6. 32 hours
7. 120 cubic feet
8. 3.6 cubic yards

Page 44:

1. 2980.25 square feet
2. 42.8 feet
3. $5740
4. $685
5. 84 men
6. 140 employees
7. 1728 cubic inches
8. 22.5 cubic feet

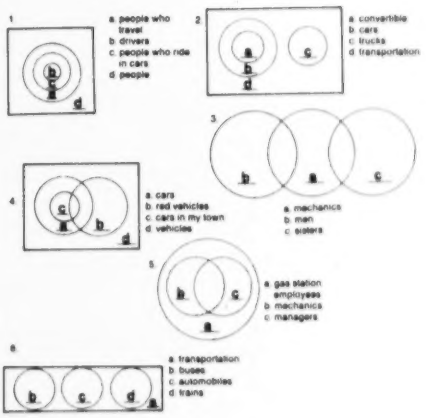
UNIT FOUR: THE SERVICE STATION

Page 45: Answers will vary.

Page 46: Answers will vary.

Page 47: Answers will vary.

Page 48:



Page 49: Calculated answers

1. 7.305
2. 15.642
3. 131.0526
4. 4462.3
5. 1402.18
6. 282.22543
7. 30.576
8. 30.687
9. 2.44
10. 3547.99
11. 85.9537
12. 1019.5652
13. 47.671

Page 50: Answers will vary.

Page 51: 144 different ways

Page 52: Answers will vary.

Pages 53-54: Answers will vary.

Page 55: 15 moves

Page 56:

1. $94.50
2. 23 mpg
3. $144
4. 325 km
5. $12.13
6. 19.2 mpg
7. 25%
8. 42 minutes

Page 57:

1. 12 mpg
2. 24 cm
3. $1091
4. $28.16
5. 43¢
6. 19.6 mpg
7. 66 minutes

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	SITUATIONS, STRATEGIES AND SOLUTIONS EMPHASIZED IN THIS BOOK	UNIT ONE PAGE	UNIT TWO PAGE	UNIT THREE PAGE	UNIT FOUR PAGE
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	Measuring body responses		17-18		
	Recording everyday math	1	16		45
	Using a calculator	9			49
	Retailing	2			
	Accounting	10-11			
	Measuring segments		26		
	Interpreting math descriptions			31	
	Interpreting function			34	
	Using indirect measuremnt			35	
Extending Knowledge	Making decisions		20-21		
	Drawing conclusions				47-48
	Evaluating careers				46
	Creating patterns			41	
	Conducting a survey			32-39	
	Creating a plan	13			
	Conducting consumer research	3-4			
	Evaluating advertising claims	5			
	Recognizing equivalent rationals	8			
Developing Strategies	Estimating				52
	Organizing data				51
	Solving sub problems			37	
	Translating into math equations			36	
	Developing procedures			33	55
	Recognizing patterns	6		42	50
	Noting problem variables	7			
	Sorting and classifying		23		
	Diagramming information		24		
	Developing trial and error strategies		27		
	Using logic statements			38	
	Constructing logic statements				53-54
Finding Solutions	Group problem solving	12	22	38-40	
	Word problems (pretest/posttest)	14-15	29-30	43-44	56-57

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